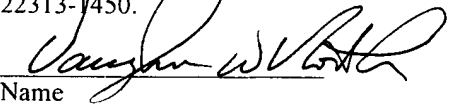




PATENT APPLICATION  
DOCKET NO. 10007804-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Huei Pei Kuo, et. al.	<b>CERTIFICATE OF DEPOSIT UNDER 37 C.F.R. § 1.8</b>
SERIAL NO.:	10/656,635	I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail, postage prepaid, under 37 C.F.R. § 1.8 on the date indicated below and is addressed to Commissioner for Patents, Alexandria, VA 22313-1450.
FILED:	September 4, 2003	
FOR:	ANODIZING PROCESS FOR IMPROVING ELECTRONIC EMISSION IN ELECTRONIC DEVICES	Name
ART UNIT:	2811	<u>Nov 10 05</u>
EXAMINER:	Hu, Shouxiang.	Date of Deposit
DOCKET NO.:	10007804-1	

**DECLARATION OF HUEI PEI KUO**  
**UNDER 37 C.F.R. § 1.132**

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

I, Huei Pei Kuo declare as follows:

1. I am a named inventor in the above-captioned application and the subject matter described and claimed therein.
2. It is my understanding that various claims in the above-recited patent application have been rejected in view of United States Patent Application Publication 2003/0143788 A1, filed January 31, 2002, and entitled "Method of Manufacturing an Emitter."
3. The invention as described and claimed in the above-referenced United States

Patent Application Serial Number 10/656,635 was conceived prior to January 31, 2002. I participated in the development of the claimed fabrication methods and electron emission devices and contributed to the disclosures which were subsequently used in preparation of the above-referenced patent application. Exhibit 1 contains a redacted version of the invention disclosures documenting the conception of the invention, which I prepared and had witnessed prior to January 31, 2002.

4. Information concerning the invention as described and claimed in the above-referenced Patent Application Serial Number 10/656,635 was communicated by myself and Xia Sheng to the inventors of United States Patent Application Publication 2003/0143788 through our common association as employees of Hewlett Packard Company during a series of in person meetings and teleconferences in the Spring and early Summer of 2001. These communications included a description of the silicon anodization technique and supporting processes, and the design of an electron emitting device and variations thereof produced with the anodization process.

5. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statement may jeopardize the validity of the application or any patent issuing thereon.

DATED this 2nd day of November, 2005.



*Hui-Pei Kuo, Inventor of the Invention*

A handwritten signature in black ink, appearing to read 'Huei-Pei Kuo', is positioned above a horizontal line.

Huei-Pei Kuo, Inventor of the Invention

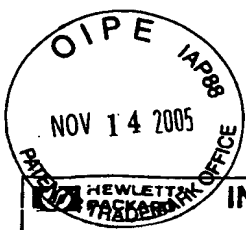


EXHIBIT 1

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1AL-PA

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## INVENTION DISCLOSURE

PDNO

10007804

DATE RCVD

10/18/00

PAGE ONE OF

4

ATTORNEY

THO

Instructions: The information contained in this document is **COMPANY CONFIDENTIAL** and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.

## Descriptive Title of Invention:

Metal Mask for Anodization

## Name of Project:

ARS

## Product Name or Number:

Was a description of the invention published, or are you planning to publish? If so, the date(s) and publication(s):

Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, the date(s) and location(s):

Was the invention disclosed to anyone outside of HP, or will such disclosure occur? If so, the date(s) and name(s):

If any of the above situations will occur within 3 months, call your IP attorney or the Legal Department now at 1-898-4919 or 970-898-4919.

Was the invention described in a lab book or other record? If so, please identify (lab book #, etc.)

Was the invention built or tested? If so, the date:

Was this invention made under a government contract? If so, the agency and contract number:

Description of Invention: Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).

- A. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).
- B. Problems solved by the invention.
- C. Advantages of the invention over what has been done before.
- D. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)

Signature of Inventor(s): Pursuant to my (our) employment agreement, I (we) submit this disclosure on this date: [ ]

1561	Huei Pei Kuo		8575407	241-18	HPL
Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name

530440	Xia Sheng				HPLJ
Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name

Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name
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Employee No.	Name	Signature	Telnet	Mailstop	Entity & Lab Name
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(If more than four inventors, include additional information on another copy of this form and attach to this document)

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HEWLETT-PACKARD INVENTION DISCLOSURE		COMPANY CONFIDENTIAL	PAGE <u>2</u> OF <u>4</u>
<b>Signature of Witness(es):</b> <i>(Please try to obtain the signature of the person(s) to whom invention was first disclosed.)</i>			
The invention was first explained to, and understood by, me (us) on this date: [ ]			
Full Name	Signature	Date of Signature	
STEVEN LOUIS NABERHUIS	<i>Steven L. Naberhuis</i>	Oct. 16, 2000	
Full Name	Signature	Date of Signature	

<b>Inventor &amp; Home Address Information:</b> <i>(If more than four inventors, include addl. information on a copy of this form &amp; attach to this document)</i>			
Inventor's Full Name <i>Huei Pei Kuo</i>			
Street <i>924 Old Town Ct</i>			
City <i>Cupertino</i>	State <i>CA</i>	Zip <i>95014</i>	
Do you have a Residential P.O. Address? P.O. BOX	City	State	Zip
Greeted as (nickname, middle name, etc.)		Citizenship	

Inventor's Full Name			
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Inventor's Full Name			
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City		State	Zip
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Inventor's Full Name			
Street			
City		State	Zip
Do you have a Residential P.O. Address? P.O. BOX		City	State Zip
Greeted as (nickname, middle name, etc.)		Citizenship	

Description of Invention: Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).

A. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).

A dielectric layer is used to delineate the regions to be anodized in porous silicon emitters. ~~The electric field is intensified at the boundary of the dielectric mask.~~ The electric field is intensified at the boundary of the dielectric mask. This causes the anodization process to accelerate along the boundary of the mask and causes non-uniform anodization.

B. Problems solved by the invention.

The non uniform anodization is minimized when a metallic or conductive material, e.g., chrome, gold, platinum, is used as the anodization mask.

C. Advantages of the invention over what has been done before.

A more uniform anodization and improved electron emission from the anodized area.

D. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)

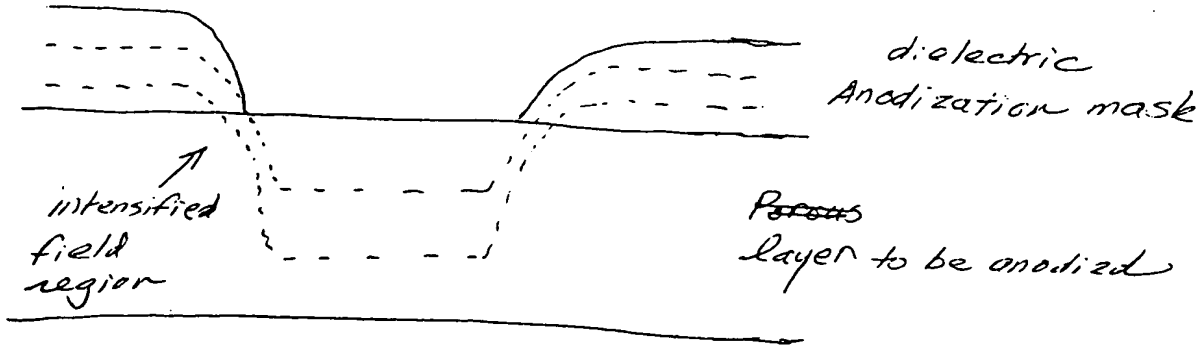
To achieve anodization of porous silicon emitters, a metallic mask is used to delineate the intended region to be anodized. The field distribution is depicted in the attached diagram.

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Dielectric mask causes electric field to be intensified at the boundary of mask

~~HF~~

~ 150V



$n^{++}$   
Substrate

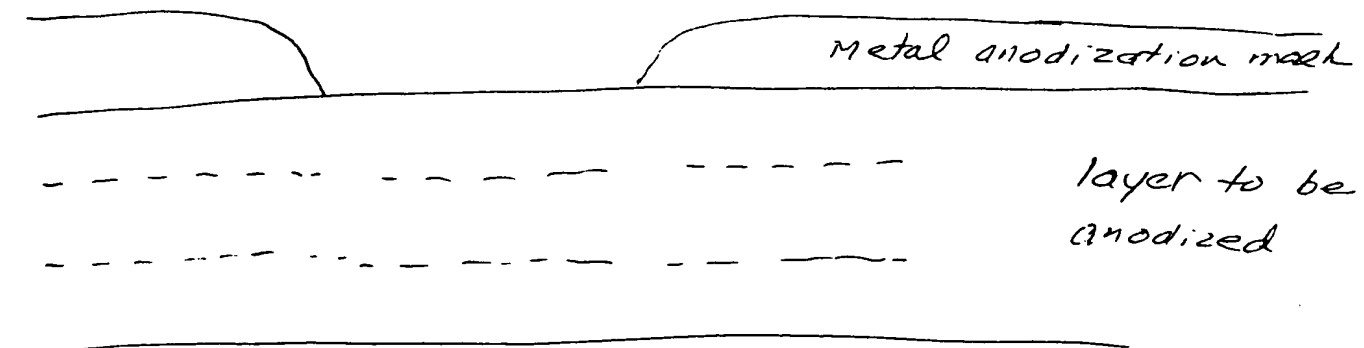
~ 150V

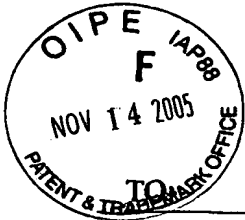
----- dashed lines indicating equipotential surfaces

Metal Mask / conductive mask

no intensified electric field at boundary of mask

HF





A C S I M I L E

TO:  
Name: Keith  
Fax #: (801) 566-6673  
Pages:

FROM:  
Name: Huei-Dei Kuo  
Fax #: (650) 852 8579  
Date/Time: 9/5/01

MESSAGE:

Keith:

This is something we would like to  
add to the patent



**received**  
**9-5-01**

V.M.



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NOV 14 2005



## INVENTION DISCLOSURE

COMPANY CONFIDENTIAL

PAGE 54 OF 56

Description of Invention: Please preserve all records of the invention and attach additional pages for the following. Each additional page should be signed and dated by the inventor(s) and witness(es).

A. Prior solutions and their disadvantages (if available, attach copies of product literature, technical articles, patents, etc.).

Electron sources from flat emission surfaces are used for various applications. A patterned dielectric layer is formed on top of the electron source to confine the electron emission to specific regions where no dielectric layer is present. The boundary lines of the dielectric layer, however, tend to have a higher electric field. This causes the electron source to emit preferentially along the border of the emission area and causes device failure along the borders.

B. Problems solved by the invention.

The high field concentration along the border of the electron emission regions is eliminated.

C. Advantages of the invention over what has been done before.

The elimination of the higher field improves the uniformity of the electron emission and improved the life time and stability of electron emission.

D. Description of the construction and operation of the invention (include appropriate schematic, block, & timing diagrams; drawings; samples; graphs; flowcharts; computer listings; test results; etc.)

The fabrication process of the electron source is depicted in the following figures.

In prior art the following three steps are used to define the emission area.

Figure 1P. A thin layer of polycrystalline silicon is grown on top of single crystalline silicon.

Figure 2P. Prior Art. A layer of dielectric material, e.g. SiO<sub>2</sub> or Si<sub>3</sub>N<sub>4</sub>, is grown or deposited.

Figure 3P. Prior art. The dielectric layer is patterned to define the emission area.

In the present invention, the following steps are used.

Figure 1I. A layer of dielectric material, e.g. SiO<sub>2</sub> or Si<sub>3</sub>N<sub>4</sub>, is grown or deposited.

Figure 2I. The dielectric layer is patterned to define the emission area.

Figure 3I. A thin layer of polycrystalline silicon is grown on top of the single crystalline silicon and the dielectric.

In both the prior art and the present invention

Figure 4. Dielectric layer grown over the structure. When the thermal oxidation is used for this step, a high field along the boarder for the devices is produced with the prior art. The high field is eliminated with the present invention.

Prior Art

Fig 1P

poly crystalline silicon (poly)

single crystal silicon (c-si)

Fig 2P

dielectric

Poly

c-si

Fig 3P

Poly

c-si

dielectric

Present Invention

Fig 1I

dielectric

c-si

Fig 2I

dielectric

c-si

dielectric

Fig 3I

Poly

dielectric

c-si